

WATER

Water Quality Implications of the Kingston Ash Spill

The ash spill at Kingston has resulted in hundreds of acres of the reservoir being smothered, fish and aquatic life killed, habitat lost, and pollutants released into the water column. Ash blocks navigation on the Emory River and has been found to extend as far as three miles upstream from the release point. Ash particles have been found in fish gills and bellies, and chemical measurements have shown violations of water quality criteria.

Lakeside residents in the spill area are severely affected. Many of these properties have been sold to TVA since the release.

Public Water Supplies - Frequent sampling of raw and finished water at the closest downstream public water supplies, Kingston and Rockwood, has consistently shown those to be unaffected by the release. TVA began sampling immediately after the incident, and TDEC started independent sampling, analysis and reporting shortly after that. For three weeks, beginning at the end of December, TDEC did daily sampling for metals and indicator pollutants. These samples were transported to our Nashville lab and the results were reported the next day. Consistently low results during that period allowed us to reduce frequency to weekly for now. Kingston and Rockwood will continue to do their own monitoring of raw and finished water at their facilities.

Private Wells - To date, TDEC has sampled and analyzed water from over 100 private wells within an approximate four mile radius of the incident. That sampling has shown no impact and all results have been reported to those property owners. We have identified sentinel wells in the vicinity of the site that we will monitor on a quarterly basis until we are confident there are no ground water impacts from the spill or recovery.

Surface Water - Heavy metals are contained in fly ash and present the greatest potential for chemical contamination of waters from the incident. Metal levels were highest immediately following and in the area of the spill. On January 2, 2009, TDEC began bi-weekly sampling of multiple stations in the area. Specific metals that have violated Tennessee water quality criteria for protection of either human health or fish and aquatic life include thallium, arsenic, lead, aluminum, iron, copper, mercury and cadmium.

Most of the violations were in the Emory River near the ash spill. Arsenic was found in the Emory River near the spill site at levels above our criteria for domestic water supply, but other sites were lower. Mercury was occasionally detected above criteria for protection of fish tissue for human consumption. Criteria for waters that serve as a source of drinking water and from which fish are consumed have also been violated by some of our thallium samples from both the Tennessee and Emory River, although there were no violations of our thallium standard for drinking water only.

Now that dredging is underway, TDEC has been on the water to observe the operations and continue sampling. Following are the results for some of the parameters of concern at TDEC's three Emory River stations downstream of the ash pile on March 24, 2009 a day TVA dredges were in operation.

Emory River Water Quality During Dredging (3/24/2009)

(All metals data are in ug/L TSS is mg/L)

	ERM 2.1	ERM 1.7	ERM 0.1
Parameter			
TSS	20	<10	<10
Aluminum	420	130	130
Iron	330	140	150
Arsenic	4.0	<0.93	<0.93
Beryllium	<0.11	<0.11	<0.11
Cadmium	<0.41	<0.41	<0.41
Copper	1.2	2.1	1.5
Lead	0.59	0.23	0.28
Selenium	<1.3	<1.3	<1.3
Thallium	0.22	0.09	0.07
Vanadium	4.3	<3.4	<3.4
Zinc	3.7	2.8	3.5
Mercury	N/A	N/A	N/A

N/A – Mercury results are not yet available due to an instrument malfunction.

None of the values in the table above are water quality standards violations. (Note: the similarity of data from the stations at Emory River mile 1.7 and 0.1 suggests that Clinch River water is being pulled upstream on the Emory River.)

Selenium - This member of the family of heavy metals has recently been raised as an issue of particular importance because of concerns that it might be liberated into the water column as a result of chemical reactions during the dredging process. The selenium criterion for fish and aquatic life protection is 5 ug/L and for drinking water it is 50 ug/L. To date, we have not seen selenium problems in samples collected after the spill.

Specifically, on the Emory River, 68 of 82 samples were non-detectable at 1.3 ug/L with the highest single sample being 3.4 ug/L. On the Clinch River, the highest of 46 samples was 3.6 ug/L, with 30 being non-detectable at 1.3 ug/L. On the Tennessee River, of the 2 samples we have, both were non-detectable at 1.3 ug/L. As indicated on the previous table, selenium was at non-detectable levels on March 24, 2009 while dredges were in operation.

In addition to the existing selenium national water concentration criterion, EPA has also provided guidance regarding levels that might indicate the potential for toxicity in fish based on tissue concentrations. This draft suggestion is 7.91 mg/kg as a dry weight concentration in whole fish.

TDEC obtained eight fish from TVA that were collected on March 12, 2009 at mile 3.0 of the Emory River, at the edge of the upper extent of the ash pile. The four redear sunfish and four largemouth bass in the sample were delivered to the state laboratory and were analyzed by species as two composite samples.

The selenium results for the sunfish and largemouth bass were 1.1 and 0.97 mg/kg, respectively. Because the EPA guidance for tissue concentrations is based on dry weight rather than wet, the results were then converted from a wet weight basis to a dry weight by means of an EPA suggested conversion factor. These results were 5.1 and 4.5 mg/kg, respectively. These results indicate the possibility of selenium uptake by fish in the area, but not at concern levels suggested by EPA for protection of fish (7.91 mg/kg).

Because of the special concerns raised over potential selenium toxicity, TDEC has solicited advice from several scientists, including those who raised the issues and others who are advising TDEC on coal ash chemistry and toxicity. Based on all these much appreciated comments and recommendations, the monitoring plan has been amended to increase oversight of selenium at the dredge site and from the ash pond, the discharge from which will now be sampled five days per week.

Map of TDEC's Surface Water Sampling Stations

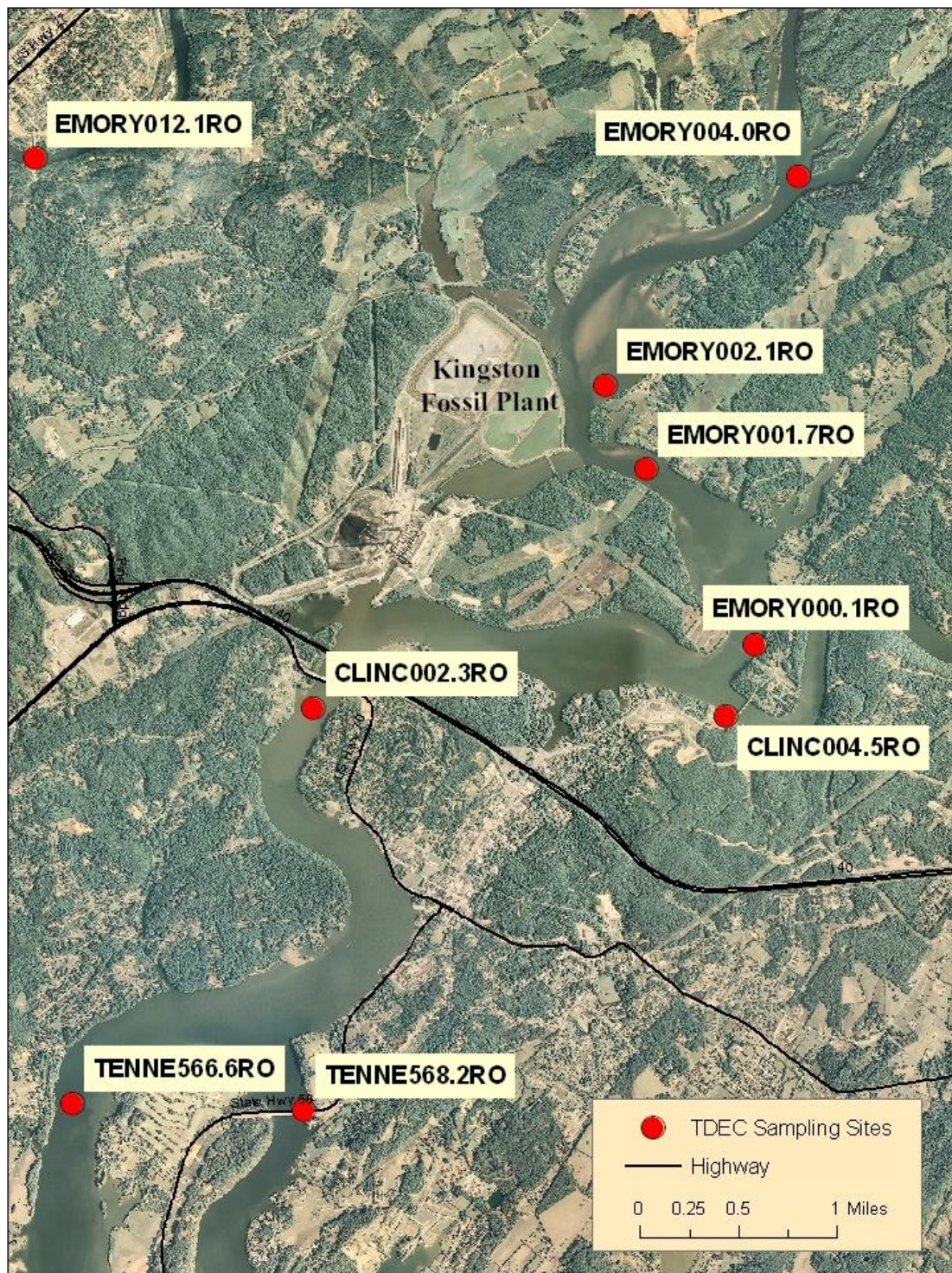


Image 4

Summary of TDEC's Surface Water Data (all values ug/L)

(Note: This table does not include other agency data.
Approximately 120 observations for each parameter.)

Metal	Lowest Criterion for Applicable Classified Uses	*Average Concentration (Detection Level)	Number of Criteria Violations	Maximum Concentration Observed
Thallium	0.24 (c)	0.17 (0.3)	23	1.50
Aluminum	750 (b)	538.6 (6.4)	10	15000
Lead	(d) 5.0 (a)	0.86 (0.1)	7	16.0
Arsenic	10 (a)	2.07 (0.93)	5	43.0
Iron	1,000 (b)	489.2 (2.9)	9	10000
Mercury	0.05 (c)	(0.13)	5	0.17
Copper	(d)	2.35 (0.38)	2	22.0
Cadmium	(d)	(0.41)	1	0.60
Selenium	5 (b)	0.90 (1.30)	0	3.60
Beryllium	4 (a)	0.12 (0.11)	0	1.60
Manganese	1000 (b)	46.1 (0.42)	0	330

* For purposes of calculating average concentrations, one-half of detection level was used for values below detection.

- (a) Criterion for protection of domestic water supply [TDEC Rule 1200-4-03-.03(1)(j)];
- (b) Criterion for protection of fish and aquatic life [TDEC Rule 1200-4-03-.03(3)(g), (h), or (i)];
- (c) Criterion for consumption of fish and drinking water from same body of water [TDEC Rule 1200-4-03-.03(4)(j)]; and
- (d) Hardness-dependant fish and aquatic life dissolved criterion.

Recreation - Both TDEC and the TDH have stated that recreation in and on the water at locations other than the immediate area of the spill should be unaffected by the incident. Still, many who might use the lake for recreation are wary, and marinas and other local tourist businesses report cancelations. TDEC is committed to helping Roane County get the message out that recreation on and near Watts Bar Reservoir is safe.

Bacteriological and Radiological Impacts - The ash does not contain bacteria that might impact recreational use of the lower Emory River. It is possible for some metals such as iron to stimulate bacteria growth. These are not disease-causing bacteria, but might cause aesthetic problems. As water temperatures warm this spring, TDEC will watch to see if this occurs.

TDEC does not consider the ash to pose a threat to water quality due to radioactivity. However, there may be pockets of radioactive cesium in area sediment from historical activities at Oak Ridge. If any of these are found to be in the impact area, special plans will need to be made to avoid disturbing them.

Fishing – Fishing in the impacted area will remain unavailable until recovery is completed. Other than in the immediate spill area, fishing is safe and it is safe to eat most kinds of fish from Watts Bar. There has been a long-term advisory against consumption of catfish, striped bass and hybrid bass from Watts Bar because of polychlorinated biphenyl (PCB) contamination, and those advisories remain unchanged. There is also an existing advisory based on mercury in fish tissue for all fish species in the Emory River from mile 12.4 to mile 21.8. That is a 9.4 mile reach above the City of Harriman. TDEC is uncertain as to the source of mercury in fish collected in that location.

In partnership with TWRA, additional fish tissue samples have been collected. Those analytical results are not yet available. TWRA has announced that they will continue a semi-annual sampling schedule for fish tissue looking for metals associated with the ash, such as selenium, arsenic, mercury, cadmium and lead. TDEC will use those results to determine if the TDEC Watts Bar advisory needs to be changed.

TDEC's advisories for consumption of fish taken from Tennessee waters are in the second half of the document at:

<http://www.tn.gov/environment/wpc/publications/advisories.pdf>

TDEC's water sampling plan is available at:

http://www.state.tn.us/environment/kingston/pdf/monitor_plans/water_sampling_plan.pdf

A map showing the locations of our surface water sampling stations and the area where wells were tested is on the next page and may also be found at:

http://www.state.tn.us/environment/kingston/pdf/monitor_plans/KingstonMap.pdf

Results of TDEC's surface water monitoring are posted at:

http://www.state.tn.us/environment/kingston/surface_water.shtml

All of our public water supply monitoring data are on TDEC's site at:
<http://www.state.tn.us/environment/kingston/wtp.shtml>

Status of Clean-Up Activities

Ash Retention Structures – Within the first days of the incident, TVA proposed and TDEC and EPA approved installation of three weirs. Weir 1 was installed below water level across the Emory River channel to retain ash that was in the river and potentially moving along the river bottom. Weir 2 was installed on the west bank of the river to retain that portion of the spilled material that was not in the reservoir. Weir 3 was installed in a slough to divert drainage water from the spill site. Weirs 1 and 2 can be seen in Figure 7 of the dredging plan and Weir 3 is shown on the Overall Site Plan in the Interim Drainage Plan (see link below).

Site Drainage Controls – TVA has developed engineering plans for controlling runoff from the exposed ash in and adjoining the Emory River. This plan has been reviewed and approved by TDEC and EPA. It is posted on TDEC's web page at:
<http://www.state.tn.us/environment/kingston/pdf/tva/ProposedInterimDrainagePlan030209.pdf>

Dredging Operations – The Phase 1 Emory River Dredging Plan will remove ash from the river channel to a depth of 710 feet mean sea level. The approved plan calls for a pilot dredging program for the first 60 days, which began on March 19, 2009. It is anticipated that a sustainable pace will be determined based on initial operations. If three dredges are operating at an estimated 20 hours per day, they will be able to move approximately 9,000 cubic yards per day.

TDEC considers that it is critical to remove the massive amount of ash now in the Emory River as soon as it can be safely done. Presently, the ash presents a risk of flooding to upstream areas in the event of a significant rainfall and perhaps a greater risk of being washed downstream where recovery would be less efficient and further complicated by mixing with legacy contaminated sediments. TDEC sought and received comments from experts in the area of dredging, coal ash, toxicology, and protection of fish and aquatic life from EPA Region 4 in Atlanta, the Region 4 Science and Ecosystem Support Division Laboratory in Athens, the Corps of Engineers Nashville District Office, the Corps' Engineer Research and Development Center Environmental Laboratory at Vicksburg, the U.S. Fish and Wildlife Service, the Tennessee Wildlife Resources Agency, and Vanderbilt University.

These comments served as the basis for TVA's revisions to the dredge plan and accompanying monitoring plan. The approved dredge plan is available at:
http://www.state.tn.us/environment/kingston/pdf/tva/ProposedDredgePlanPhaseI_022309.pdf